

Comment on **essd-2022-114**

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Referee comment on "Shallow-groundwater-level time series and a groundwater chemistry survey from a boreal headwater catchment, Krycklan, Sweden " by Jana Erdbrügger et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-114-RC1>, 2022

Erdbrügger et al. present a database of groundwater level recorded at 75 wells in a Swedish experimental catchment for two years, from July 2018 to November 2020. They also present the hydrochemistry acquired in the wells during one sampling campaign in summer 2019. A full description from the setup of the well network to the data quality are presented. Additionally, some results illustrate the interest of having such hydrological/hydrogeological data published.

As it is more and more important having access to such information, the publication of these data is for me very relevant. However, I also think that the manuscript, as submitted, needs a substantial improvement before being published in ESSD. Please see below my general comments.

- A clear definition of what is a "shallow groundwater" should be given. Indeed, by reading the entire manuscript we are lost in between "shallow" GW, GW or even deep GW. You should more clearly explain what are the different groundwater that you had access with your wells in this catchment. If you only look at shallow GW, please explain it more clearly.
- The structure of the regolith (soil-saprolite-fractured bedrock-fresh bedrock) of the catchment needs to be presented with a more rigorous and complete description. More specifically, the very short description of the soil is not clear at all and do not give the minimum information we need to link with the GW dynamics or with the water chemistry. You should provide information on the spatial variability of the soil properties (depth, WRB soil type, some basic pedological parameters and if available physical parameters related to hydrology) at both sub catchment and hillslope scales.
- The GW chemistry was only recorded during one sampling campaign in July 2019 which is not representative of the complete GW level range you monitored for 2 years. You should explain what you did expect from this sampling and what is the added value having these data published together with the GW level. The different wells were sampled at different dates and during this period precipitation happened (about 28mm, which is not negligible, isn't it?): how different were the hydrological conditions during

these sampling dates? How could such differences affect the spatial variability you observed and the GW connectivity in between wells?

- The size of the manuscript should be reduced by removing most of the tables. Indeed, the table information is always described in the text (redundancy). Moreover, the information that is presented in the tables could be more relevant in direct link to (or inside) the files provided online under the "safedeposit" website. Some figures could be merged to reduce its number (see below).
- Online files need to be improved (information missing, not clear enough, language harmonization)

Please find below some more detailed suggestions/comments:

Title

The name of the catchment and the country should appear in the title

- Introduction

Lines 28-29: I don't see the choice of N and Hg relevant when speaking about GW solutes. You should find a better choice.

Line 43: "...understanding **of** hydrological..."

Line 97: "Shallow" GW?

- description of the study area

Line 107: catchment area?

Line 108: "long-term data": give the initial and final dates that cover the time series

Line 125-126: not clear at all

Line 127: 6m depth, is this soil developed on deposited material (colluvium, alluvium...)?

Line 137: The ICOS station should be presented on the map in figure 1

- Groundwater wells

Lines 176-177: better to give the range than the average

- Dataset 1

Lines 341-243: why not using the same procedure for all wells?

Lines 266-270: precision of the measure by the automatic sensors?

Line 302: The first step for the manual selection should be shown in figure 5 to clarify all the used procedure.

Lines 306-309: this is not clear to me. Please explain why this can happen. Is it because this measurement is not always as sensitive even if correctly done?

Line 342: "recovery time", should be interesting to know the necessary time to recover at each well to show the spatial heterogeneity of some hydraulic properties. This could be one of the example results, for instance.

- Dataset 2

Line 393: how often, the wells were dried and in what hydrological state?

Lines 397-399: the purging description (lines 390-395) should appear in this paragraph because it is a part of the sampling protocol.

Line 407: which should correspond to the shallower part of the GW, shouldn't it?

Line 412: what pumping speed? Was it low enough to completely avoid this effect? How did you evaluate this for all wells and how variable was it for all wells?

- Example results

Line 432: is it not mainly transpiration that would affect GW level? Can evaporation from the surface of the soil impact the GW level?

Lines 433-434: how many wells and why these ones?

Line 444: The deep GW was not defined previously

Line 445: what statistical test did you use to estimate the significance?

Line 446: is it not 12.5 because in the figure the range is closer to 10. If not 1.25 is in the same order of magnitude that the mean analytical error we have with standard isotope analyzer, then not really large.

Tables

Tables 1 and 2 are not necessary

Tables 4 and 5 should be removed and their information added to the related online files

Table 6 is not necessary as fully described in the text at 4.4. The caption is not detailed enough. Is it for manual or logger data?

Table 8 not needed

Figures

Figure 1 and 2 should be merged and well labelling added on Figure 2

Figure 4 is not clear. All the information provided in the figure caption should be indicated on the figure too.

Figure 6 and 7 should be merged to show the 6 different classes together.

The legend should be added on figure 8

Appendix A should be put in the online repository with the other files.

Online files

Kryckland_gw_levels.csv: avoid the acronyms and put together the column for mnl

Kryckland_gw_sampling.csv and Kryckland_gw_chemistry.csv should be merged in one file

Field_protocol.csv is not clear because some column (like Y and Z) do not have title and what means g/d in column N?

Lab_analysis_description.pdf: harmonized the language to english